Lesson 11

Topic: Data representation and interpretation

Calculating measures of centre and spread using technology

Lesson concepts

- Data interpretation — Variation
- Data interpretation — Measures of central tendency

Lesson notes

In Lesson 11, students calculate the mean, median, mode and range using a spreadsheet.

Lesson answers

1. Students watch the **Video — Calculating measures of centre using a spreadsheet**.
2. a. Answers will vary depending on student hand span.

   b–c. Answers will vary depending on student hand span. Sample response: (additional student hand span = 17 cm).

	B2		= AVERAGE (A2:A11)	
	A	**B**	**C**	**D**
1	Hand spans (cm)			
2	16	17.3	Mean	
3	18	17.5	Median	
4	15	18	Mode	
5	16	5	Range	
6	18			
7	18			
8	17			
9	20			
10	18			
11	17			

3. The answers for a–d. are:

	A	B	C	D	E	F
1	Dice 1	Dice 2	Dice 1 x Dice 2	Sorted Outcomes		
2	1	1	1	1	**6.25**	Mean
3	1	2	2	2	**5**	Median
4	1	3	3	2	**4**	Mode
5	1	4	4	3	**15**	Range
6	2	1	2	3		
7	2	2	4	4		
8	2	3	6	4		
9	2	4	8	4		
10	3	1	3	6		
11	3	2	6	6		
12	3	3	9	8		
13	3	4	12	8		
14	4	1	4	9		
15	4	2	8	12		
16	4	3	12	12		
17	4	4	16	16		

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4. Answers will vary depending on data found.

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Lessons 12–13

Topic: Data representation and interpretation

Problem solving and reasoning by applying statistics to an inquiry involving dice

Lesson concepts

- Data interpretation — Variation
- Data interpretation — Measures of central tendency

Lesson notes

In Lessons 12–13, students solve a problem using digital technology and an understanding of statistics.

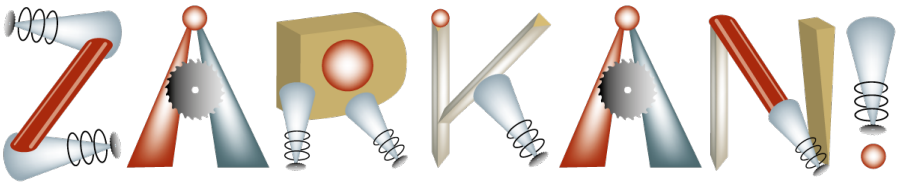
Lesson answers

1. Student responses will vary.
2. Student responses will vary.
3. Students read **Sheet 10 — Zarkan**.
4. a. The number of seconds that the robot defender is unable to function.
   b. Yes, because the larger the number the longer the robot is out of action.
   c. They have different outcomes and so it changes how effective they are.
   d. 8 seconds. (7 seconds for the number rolled and an extra 1 second for the Plus 1 boost.)
   e. 8 seconds. (Add the two numbers together. No boost because for Max power you only get a boost when you roll a total of 11 or 12.)
   f. 21 seconds. (11 seconds for the roll and a bonus 10 seconds for the Max power boost, as the total is 11.)
   g. They increase the total score either by occasionally increasing the score by 10, or always increasing it by 1.
   h. Measures of centre, probability, ratios.
5. a. Find the mean, median and mode of all scrambler/skill boost combinations.
   b. Binary Blaster and Max power
      Binary Blaster and Plus 1
      Zappy Zapper and Max power
      Zappy Zapper and Plus 1
      Nullifier and Max power
      Nullifier and Plus 1
   c. For example: Either compare the means or medians (depends on the effect of outliers) to identify, which combination results in the highest number.
   d. Personal response required.

6–8. **Sheet 10 — Zarkan** (attached).

Sheet 10 Answers

Zarkan



What is the best character for the game *Zarkan*?

An sample response of the data arranged in a spreadsheet is shown at the end of these answers.

Develop

Example of mathematical calculation

I used an organised list to identify all possible outcomes of a dice roll. This was particularly important for the scramblers that used two dice.

For the Zappy Zapper and the Nullifier I added all the possible combinations of dice rolls.
An example of the spreadsheet formula I used is shown in Table 1.

The pattern for two six-sided dice was:

Dice 1	Dice 2	Dice 1 + Dice 2
1	1	=H4+I4
1	2	3
1	3	4
1	4	5
1	5	6
1	6	7
2	1	3
2	2	4
….	…..	…

I pasted this list in the next column and sorted it into ascending order. I copied this sorted list and pasted three more columns in the skill boost section. I then adjusted the possible outcomes after taking into account the effect of each skill boost. This involved adding numbers (Max power: adding 10 to dice outcomes of 11 and 12; and Plus 1: adding 1 to each dice outcome).

Note: The full results are displayed in the spreadsheet at the end of these answers.

Example of mathematical calculation

I used the following spreadsheet functions to calculate mean, median and mode: AVERAGE(), and MEDIAN(). I calculated mode manually.

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Comparison of scrambler/skill boost statistics

A summary table of the measures of centre is shown below.

	Binary Blaster		Zappy Zapper		Nullifier	
	Max power	**Plus 1**	**Max power**	**Plus 1**	**Max power**	**Plus 1**
Mean	8.17	7.5	7.83	8	7.94	8
Median	6.5	7.5	7	8	7	8
Mode	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 22, 23	2 to 13	7	8	5, 6, 7, 8, 9	6, 7, 8, 9, 10

Students may also use probability as evidence.

Defend

Sample response.

Student interpretation of the table will vary. The answer they provide will vary depending on the relative weight they give to mean, median and mode or to other evidence (such as probability).

Some students may immediately choose the highest mean, which is the Binary Blaster + Max power combination. However, this also has the lowest median. Since the final two numbers are much higher than the rest, these could be considered outliers and so the median might be a better measure of centre than the mean in this case.

Another choice might be the Nullifier + Max power combination. This has the third highest mean, and median is higher than the previous example. However the median is 7, which is lower than some of the other options.

Others could choose:

- the Zappy Zapper + Plus 1 combination, which has the highest combination of mean, median and mode.
- the Nullifier + Plus 1 combination, which has the same value of eight for the mean and median; however, the mode is 6, 7, 8, 9 and 10. Students may interpret this in different ways. Also students could look at probabilities, where the probability of rolling 6 or more is higher (83.3 per cent) for the Zappy Zapper + Plus 1 combination than the Nullifier (81.3 per cent).

Sheet 10 Answers

Sample response data for inquiry task Zarkan

Binary-Scrambler — One 12-sided dice

	Outcomes of rolling the	Skill boost: Max-power: Add 11 to rolls of 11 & 12	Skill boost: Plus-1: Add 1 to each dice roll.
	1	1	2
	2	2	3
	3	3	4
	4	4	5
	5	5	6
	6	6	7
	7	7	8
	8	8	9
	9	9	10
	10	10	11
	11	22	12
	12	23	13
mean	6.50	**8.33**	7.50
median	6.5	6.5	7.5
mode			

appy-Zapper — Two six-sided dice added together

Dice 1 (6)	ice 2 (6	Outcomes: Dice 1 + Dice 2	Outcomes in order	Skill boost: Max-power: Add 11 to rolls of 11 & 12	Skill boost: Plus-1: Add 1 to each dice
1	1	2	2	2	3
1	2	3	3	3	4
1	3	4	3	3	4
1	4	5	4	4	5
1	5	6	4	4	5
1	6	7	4	4	5
2	1	3	5	5	6
2	2	4	5	5	6
2	3	5	5	5	6
2	4	6	5	5	6
2	5	7	6	6	7
2	6	8	6	6	7
3	1	4	6	6	7
3	2	5	6	6	7
3	3	6	6	6	7
3	4	7	7	7	8
3	5	8	7	7	8
3	6	9	7	7	8
4	1	5	7	7	8
4	2	6	7	7	8
4	3	7	7	7	8
4	4	8	8	8	9
4	5	9	8	8	9
4	6	10	8	8	9
5	1	6	8	8	9
5	2	7	8	8	9
5	3	8	9	9	10
5	4	9	9	9	10
5	5	10	9	9	10
5	6	11	9	9	10
6	1	7	10	10	11
6	2	8	10	10	11
6	3	9	10	10	11
6	4	10	11	22	12
6	5	11	11	22	12
6	6	12	12	23	13
		mean	7.00	7.92	**8.00**
		median	7	7	**8**
		mode	7	7	**8**

Nullifier — An 8-sided and 4-sided dice added together

Dice 1 (8)	ice 2 (4	Outcomes: Dice 1 + Dice 2	Outcomes in order	Skill boost: Max-power: Add 11 to rolls of 11 & 12	Skill boost: Plus-1: Add 1 to each dice roll.
1	1	2	2	2	3
2	1	3	3	3	4
3	1	4	3	3	4
4	1	5	4	4	5
5	1	6	4	4	5
6	1	7	4	4	5
7	1	8	5	5	6
8	1	9	5	5	6
1	2	3	5	5	6
2	2	4	5	5	6
3	2	5	6	6	7
4	2	6	6	6	7
5	2	7	6	6	7
6	2	8	6	6	7
7	2	9	7	7	8
8	2	10	7	7	8
1	3	4	7	7	8
2	3	5	7	7	8
2	3	5	8	8	9
4	3	7	8	8	9
5	3	8	8	8	9
6	3	9	8	8	9
7	3	10	9	9	10
8	3	11	9	9	10
1	4	5	9	9	10
2	4	6	9	9	10
3	4	7	10	10	11
4	4	8	10	10	11
5	4	9	10	10	11
6	4	10	11	22	12
7	4	11	11	22	12
8	4	12	12	23	13
		mean	7.00	**8.03**	**8.00**
		median	7	7	**8**
		mode	5	5, 6, 7, 8, 9	6, 7, 8, 9, 10

Binary-Scrambler - One 12-sided dice

		Skill boost	
		Max-Power	Plus-1
	Outcomes of	Add 11 to rolls of 11 & 12	Add 1 to each dice roll.
	1	1	2
	2	2	3
	3	3	4
	4	4	5
	5	5	6
	6	6	7
	7	7	8
	8	8	9
	9	9	10
	10	10	11
	11	22	12
	12	23	13
mean	6.50	**8.33**	7.50
median	6.5	6.5	7.5
mode		All	

Zappy-Zapper - Two six-sided dice added together.

Outcomes without skill-boost

Mean 7
Median 7
Mode 7

DICE 1 \ DICE 2	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Max-power
Add 11 to rolls of 11 & 12

Mean 7.92
Median 7.00
Mode 7.00

DICE 1 \ DICE 2	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	22
6	7	8	9	10	22	23

Plus-1
Add 1 to each dice roll.

Mean 8.00
Median 8.00
Mode 8.00

DICE 1 \ DICE 2	1	2	3	4	5	6
1	3	4	5	6	7	8
2	4	5	6	7	8	9
3	5	6	7	8	9	10
4	6	7	8	9	10	11
5	7	8	9	10	11	12
6	8	9	10	11	12	13

Nullifier - An 8-sided and 4-sided dice added together.

DICE 1 \ DICE 2	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9
2	3	4	5	6	7	8	9	10
3	4	5	6	7	8	9	10	11
4	5	6	7	8	9	10	11	12

Mean 7
Median 7
Mode 5,6,7,8,9

Max-power
Add 11 to rolls of 11 & 12

DICE 1 \ DICE 2	1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8	9
2	3	4	5	6	7	8	9	10
3	4	5	6	7	8	9	10	22
4	5	6	7	8	9	10	22	23

Mean 8.03
Median 7
Mode 5,6,7,8,9

Plus-1
Add 1 to each dice roll.

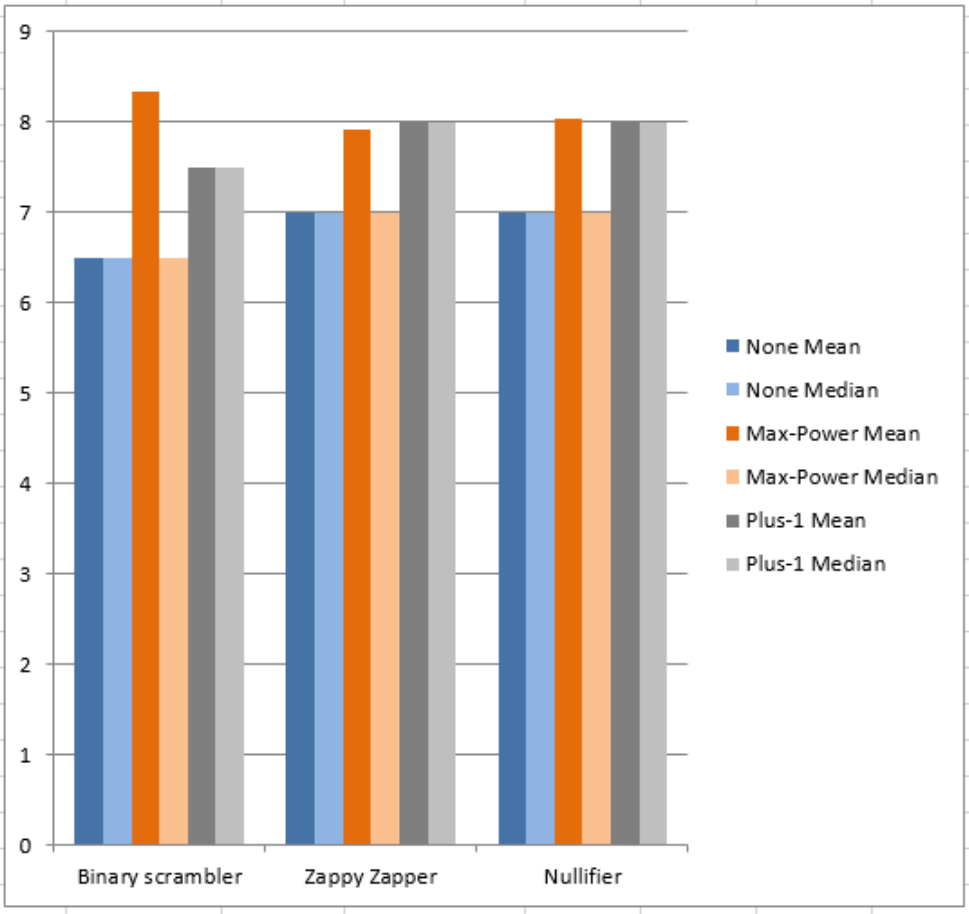
DICE 1 \ DICE 2	1	2	3	4	5	6	7	8
1	3	4	5	6	7	8	9	10
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13

Mean 8
Median 8
Mode 6,7,8,9,10

Sheet 10 Answers

Sheet 10 Answers

	None		Max-Power		Plus-1	
	Mean	Median	Mean	Median	Mean	Median
Binary scrambler	6.5	6.5	8.33	6.5	7.5	7.5
Zappy Zapper	7	7	7.92	7	8	8
Nullifier	7	7	8.03	7	8	8



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